CLAIMS

What is claimed is:

1. A method for reducing spurious emissions in an amplified signal by applying pre-distortion, whose magnitude is frequency-dependent, to an input signal to generate a pre-distorted signal, such that, when the pre-distorted signal is applied to an amplifier to generate the amplified signal, the pre-distortion reduces spurious emissions in the amplified signal, wherein the pre-distorted signal is generated by:

(a) generating a positive-frequency pre-distortion signal corresponding to positive-frequency components of the input signal;

(b) generating a negative-frequency pre-distortion signal corresponding to negative-frequency components of the input signal; and

(c) combining the positive- and negative-frequency pre-distortion signals to generate the pre-distorted signal.

2. The invention of claim 1, wherein the phase of the pre-distortion is also frequency-dependent.

3. The invention of claim 1, wherein:

the positive-frequency pre-distortion signal is generated by:

(1) generating a first set of one or more waveforms corresponding to a first set of one or more pre-distortion parameters;

(2) differentiating the first set of one or more waveforms with respect to time to generate a first set of one or more differentiated waveforms; and

(3) applying the first set of one or more differentiated waveforms to a positive-frequency operation to generate the positive-frequency pre-distortion signal; and

the negative-frequency pre-distortion signal is generated by:

(1) generating a second set of one or more waveforms corresponding to a second set of one or more pre-distortion parameters different from the first set of one or more pre-distortion signals;

(2) differentiating the second set of one or more waveforms with respect to time to generate a second set of one or more differentiated waveforms; and

(3) applying the second set of one or more differentiated waveforms to a negative-frequency operation to generate the negative-frequency pre-distortion signal

4. The invention of claim 3, wherein the first and second sets of one or more pre-distortion parameters are retrieved from look-up tables using an index value based on a power level of the input signal.

5. The invention of claim 4, wherein the power level is a function of I^2+Q^2, where the input signal is represented by I and Q signals.

6. The invention of claim 3, wherein the positive- and negative-frequency operations are implemented using filters.

7. The invention of claim 3, wherein:

the first set of one or more waveforms is differentiated before being applied to the positive-frequency operation; and

the second set of one or more waveforms is differentiated before being applied to the negative-frequency operation.

8. The invention of claim 1, further comprising the steps of:

generating a frequency-independent pre-distorted signal from the input signal; and

combining the frequency-independent pre-distorted signal and the positive- and negative-frequency pre-distortion signals to generate a combined pre-distorted signal.

9. The invention of claim 1, wherein:

the input signal is represented in a base-band domain; and

the positive- and negative-frequency pre-distortion signals are generated in a digital domain.

10. An apparatus for applying pre-distortion to an input signal to generate a pre-distorted signal, such that, when the pre-distorted signal is applied to an amplifier to generate an amplified signal, the pre-distortion reduces spurious emissions in the amplified signal, the apparatus comprising:

(a) a main signal processing path adapted to generate a main pre-distortion signal from the input signal;

(b) a positive-frequency secondary signal processing path adapted to generate a positive-frequency pre-distortion signal corresponding to positive-frequency components of the input signal;

(c) a negative-frequency secondary signal processing path adapted to generate a negative-frequency pre-distortion signal corresponding to negative-frequency components of the input signal; and

(d) a combiner adapted to combine the positive- and negative-frequency secondary pre-distortion signals with the main pre-distortion signal to generate the pre-distorted signal.

11. The invention of claim 10, wherein the phase of the pre-distortion is also frequency-dependent.

12. The invention of claim 10, wherein:

the main signal processing path is adapted to generate a frequency-independent pre-distorted signal from the input signal;

the positive-frequency secondary signal processing path is adapted to generate the positive-frequency pre-distortion signal by:

(1) generating a first set of one or more waveforms corresponding to a first set of one or more pre-distortion parameters;

(2) differentiating the first set of one or more waveforms with respect to time to generate a first set of one or more differentiated waveforms; and

(3) applying the first set of one or more differentiated waveforms to a positive-frequency operation to generate the positive-frequency pre-distortion signal; and

the negative-frequency secondary signal processing path is adapted to generate the negative-frequency pre-distortion signal by:

(1) generating a second set of one or more waveforms corresponding to a second set of one or more pre-distortion parameters different from the first set of one or more pre-distortion signals;

(2) differentiating the second set of one or more waveforms with respect to time to generate a second set of one or more differentiated waveforms; and

(3) applying the second set of one or more differentiated waveforms to a negative-frequency operation to generate the negative-frequency pre-distortion signal.

13. The invention of claim 12, wherein the first and second sets of one or more pre-distortion parameters are retrieved from look-up tables using an index value based on a power level of the input signal.

14. The invention of claim 13, wherein the power level is a function of I^2+Q^2, where the input signal is represented by I and Q signals.

15. The invention of claim 12, wherein the positive- and negative-frequency operations are implemented using filters.

16. The invention of claim 12, wherein:

the first set of one or more waveforms is differentiated before being applied to the positive-frequency operation; and

the second set of one or more waveforms is differentiated before being applied to the negative-frequency operation.

17. The invention of claim 12, wherein:

the main signal processing path comprises:

(1) an index generator adapted to generate index values proportional to envelope power of the input signal; and

(2) a first look-up table adapted to provide first and second pre-distortion parameters using the index values;

the positive-frequency secondary signal processing path comprises:

(1) a second look-up table adapted to provide third and fourth pre-distortion parameters using the index values;

(2) a multiplier adapted to multiply the input signal by the third and fourth pre-distortion parameters to generate first multiplied signals;

(3) a differentiator adapted to differentiate the first multiplied signals with respect to time to generate first differentiated signals; and

(4) a positive-frequency filter adapted to filter the first differentiated signals; and

the negative-frequency secondary signal processing path comprises:

(1) a third look-up table adapted to provide fifth and sixth pre-distortion parameters using the index values;

(2) a multiplier adapted to multiply the input signal by the fifth and sixth pre-distortion parameters to generate second multiplied signals;

(3) a differentiator adapted to differentiate the second multiplied signals with respect to time to generate second differentiated signals; and

(4) a negative-frequency filter adapted to filter the second differentiated signals..

18. The invention of claim 10, wherein:

the input signal is represented in a base-band domain; and

the positive- and negative-frequency pre-distortion signals are generated in a digital domain.